should also be less than 45°, thereby ensuring a complete and balanced stress spreader of underfill. Additionally, each region of underfill 220 should be thick enough to ensure minimum shrinkage and maximum retention of the bulk fill allowing creation of the best case material performance and easiest methodology of underfill process across the space between the edge of die 110 and dam 240.

Cont'd A4

Please replace paragraph **[0033]** with the following amended paragraph.

[0033] As noted herein, a dam shapes the edge of an underfill structure in a flip-chip package to reduce stress concentrated around the edge of the die. The resulting flip-chip package has superior planarity of the substrate for better connections of the BGA, superior reliability by avoiding inhomogeneity in the coefficient of thermal expansion and associated stress during thermal cycling, and better mechanical attachment of the die and substrate when compared to conventional flip-chip packages.

A5

IN THE CLAIMS

The following are clean versions of the claims being presented for examination. In accordance with 37 C.F.R. § 1.121(c)(1)(ii), marked up versions of newly amended claims are on one or more separate pages accompanying this response.

1. (Amended) A packaged device comprising:

a substrate having conductive traces on a first face and a ball grid array on a second face that is opposite the first face;

a die having metal bumps formed on a major surface of the die, the die being placed so that the metal bumps contact the conductive traces on the first face of the substrate, wherein an edge of the die overlies a portion of the ball grid array;

A6

a dam surrounding the die on the first face of the substrate; and

an underfill filling of a gap between the die and the substrate and extending from under the die onto the first face of the substrate, wherein the dam confines and shapes an edge of the underfill that overlies a portion of the ball grid array.

2. (Amended) The device of claim 1, wherein the underfill has a wetting angle at the

THE PATENT LAW OFFICES
OF DAVID MILLERS
6560 ASHFIELD COURT
SAN JOSE, CA 95120
PH: (408) 927-6700
FX: (408) 927-6701

edge of the die that is less than 45° down from a top surface of the die.

3. (Amended) The device of claim 1, wherein the underfill has a wetting angle at the dam that is less than 45° down from a top surface of the dam.

4. (Amended) The device of claim 1, wherein the ball grid array has a pitch that is less than or about equal to one half a separation between the dam and an edge of the die.

5. The device of claim 4, wherein the dam has a width that is between one and two times the pitch of the ball grid array.

6. The device of claim 1, wherein the dam comprises a structure attached to the substrate.

Cont'd A6

7. The device of claim 1, wherein the die resides inside a depression in the substrate, and the dam comprises a portion of the substrate surrounding the depression.

8. (Amended) The device of claim 1, wherein the dam comprises a treated region of the substrate on which a bead of the underfill resides, the underfill when liquid having a higher affinity for the treated region than for an adjacent region of the substrate so that the treated region confines and shapes the edge of the underfill.

9. (Amended) A method for packaging an integrated circuit die, comprising:

attaching the die to a substrate so that metal bumps on the die contact conductive traces on a first face of the substrate and an edge of the die overlies a ball grid array on a second face of the substrate;

forming a dam on the first face of the substrate; and

filling a volume between the die and the substrate and between the die and the dam with an underfill material, wherein an edge of the underfill material overlies the ball grid array.

THE PATENT LAW OFFICES
OF DAVID MILLERS
6560 ASHFIELD COURT
SAN JOSE, CA 95120
PH: (408) 927-6700
FX: (408) 927-6701

10. The method of claim 9, wherein forming the dam comprises:

depositing a flexible material on the substrate; and

curing the flexible material to form the dam.

11. The method of claim 9, wherein forming the dam comprises:

preforming the dam; and

attaching the preformed dam to the substrate.

12. (Amended) The method of claim 9, wherein forming the dam comprises treating a region of the substrate so that the treated region has a higher affinity to the underfill material than does an adjacent region of the substrate, the treated region limiting flow of the underfill material during the filling.

Cont'd A6

13. (Amended) The method of claim 9, wherein:

forming the dam comprises removing a portion of the substrate to form in the substrate a depression with the dam being a wall of the depression; and wherein

attaching the die attaches the die in the depression.

14. (Amended) The method of claim 9, wherein filling the volume comprises applying a liquid underfill material into the volume until the underfill material has a wetting angle at the die that is less than 45° down from a top surface of the die.

15. (Amended) The method of claim 9, wherein filling the volume comprises applying a liquid underfill material into the volume until the underfill has a wetting angle at the dam that is less than 45° down from a top surface of the dam.

16. (Amended) The method of claim 9, wherein forming the dam comprises positioning the dam away from the edge of the die by a separation greater than about twice a pitch of the ball grid array on the substrate.

17. (Amended) The method of claim 9, wherein forming the dam comprises providing the dam with a width that is between one and two times a pitch of the ball grid array on the substrate.

THE PATENT LAW OFFICES
OF DAVID MILLERS
6560 ASHFIELD COURT
SAN JOSE, CA 95120
PH: (408) 927-6700
FX: (408) 927-6701

Please add the following claims.

18. (New) The method of claim 9, wherein filling limits the underfill to a level below a top surface of the die.

19. (New) A method for packaging an integrated circuit die, comprising:

attaching the die to a substrate so that metal bumps on the die contact conductive traces on a face of the substrate;

treating the face of the substrate so that a fill material when liquid has a higher affinity for a first portion of the substrate and a lower affinity for a second portion of the substrate, wherein the first portion surrounds an area where the die attaches to the substrate and the second portion surrounds the first portion; and

dispensing the fill material as a liquid to fill a gap between the die and the substrate, wherein the fill material flows onto the first portion of the substrate, and the higher affinity of the first portion causes the fill material to bead on the first portion of the substrate.

A7

20. (New) The method of claim 19, wherein treating the face of the substrate comprises forming a region of a material on the first portion of the substrate.

21. (New) The method of claim 20, wherein the material comprises a substance selected from the group consisting of polymers, metals, ceramics, and combination thereof.

22. (New) The method of claim 19, wherein treating the face of the substrate comprises roughening the first portion of the substrate.

23. (New) The method of claim 19, further comprising curing the fill material to preserve a shape of the fill material including a bead on the first portion.

24. (New) The method of claim 19, wherein beading of the liquid fill material on the first portion of the substrate prevents formation of thin fillet regions of the fill material.

THE PATENT LAW OFFICES
OF DAVID MILLERS
6560 ASHFIELD COURT
SAN JOSE, CA 95120
PH: (408) 927-6700
FX: (408) 927-6701

REMARKS

The above amendment amends the specification to correct errors, improve clarity, and update a reference to a co-filed patent application. No new matter is added.